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GASB STATEMENT NO. 68 REPORT

FOR THE

MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

MEASUREMENT DATE: JUNE 30, 2019

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November 4, 2019

Board of Trustees
Missouri State Employee' Retirement System
907 Wildwood Drive
Jefferson City, Missouri 65109

Dear Board Members:

Presented in this report is information to assist the Missouri State Employees' Retirement System in providing information required under the Governmental Accounting Standards Board (GASB) Statement No. 68 to participating employers. GASB Statement No. 68 establishes accounting and financial reporting requirements for governmental employers who provide pension benefits to their employees through a trust. This report has been prepared as of June 30, 2019, the Measurement Date. The calculations in this report have been made on a basis that is consistent with our understanding of this accounting standard (GASB 68). Please note that the discount rate used to determine the Total Pension Liability changed from 7.25% at the Prior Measurement Date to 7.10% at the current Measurement Date.

The annual actuarial valuation used as a basis for much of the information presented in this report was performed as of June 30, 2019. The valuation was based upon data, furnished by the System's staff, concerning active, inactive and retired members along with pertinent financial information. This information was reviewed for completeness and internal consistency, but was not audited by us. The valuation results depend on the integrity of the data. If any of the information is inaccurate or incomplete, our results may be different and our calculations may need to be revised. Please see the actuarial valuation for additional details on the funding requirements for the System, including actuarial assumptions and methods and the funding policy.

To the best of our knowledge, the information contained in this report is complete and accurate. The calculations were performed by qualified actuaries according to generally accepted actuarial principles and practices, as well as in conformity with Actuarial Standards of Practice issued by the Actuarial Standards Board. The calculations are based on the current provisions of the System, and on actuarial assumptions that are internally consistent and individually reasonable based on the actual experience of the System. In addition, the calculations were completed in compliance with applicable law and, in our opinion, meet the requirements of GASB 68.

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These results are only for financial reporting and may not be appropriate for funding purposes or other types of analysis. Calculations for purposes other than satisfying the requirements of GASB 68 may produce significantly different results. Future actuarial results may differ significantly from the current results presented in this report due to such factors as changes in plan experience or changes in economic or demographic assumptions.

We, Patrice A. Beckham, FSA and Bryan K. Hoge, FSA, are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein. We are available to answer any questions on the material contained in this report or to provide explanations or further details as may be appropriate.

Respectfully submitted,

Patrice Beckham

Patrice Beckham, FSA, EA, FCA, MAAA
Principal and Consulting Actuary

Bryan K. Hoge, FSA, EA, FCA, MAAA
Senior Actuary

TABLE OF CONTENTS

GASB STATEMENT NO. 68

MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

SECTION I - SUMMARY OF PRINCIPAL RESULTS

Valuation Date (VD):	June 30, 2019
Prior Measurement Date:	June 30, 2018
Measurement Date (MD):	June 30, 2019
Membership Data:	
Retirees and Beneficiaries	49,696
Inactive Vested Members	16,873
Inactive Nonvested Members	18,852
Active Employees	46,864
Total	132,285
Single Equivalent Interest Rate (SEIR):	
Long-Term Expected Rate of Return	7.10%
Municipal Bond Index Rate at Prior Measurement Date	3.89%
Municipal Bond Index Rate at Measurement Date	3.50%
Year in which Fiduciary Net Position is Projected to be Depleted	N/A
Single Equivalent Interest Rate at Prior Measurement Date	7.25%
Single Equivalent Interest Rate at Measurement Date	7.10%
Net Pension Liability:	
Total Pension Liability (TPL)	$13,957,626,309
Fiduciary Net Position (FNP)	7,916,465,279
Net Pension Liability (NPL = TPL – FNP)	$6,041,161,030
FNP as a percentage of TPL	56.72%
Collective Pension Expense:	$1,227,630,804
Collective Deferred Outflows of Resources:	$744,524,450
Collective Deferred Inflows of Resources:	$99,175,145

SECTION II – INTRODUCTION

The Governmental Accounting Standards Board issued Statement No. 68 (GASB 68), *"Accounting and Financial Reporting for Pensions"* in June 2012. GASB 68's effective date for employers is the first fiscal year beginning after June 15, 2014.

This report, prepared as of June 30, 2019 (the Measurement Date), presents information to assist the Missouri State Employees' Retirement System in providing the required information under GASB 68 to participating employers. Employers can use the information in this report for fiscal years ending on or before June 30, 2020. The Missouri State Employees' Retirement System is a cost-sharing multiple employer plan, so the Net Pension Liability and Pension Expense are allocated among the participating employers. Those amounts, which are needed for the employers' financial statements, are provided in Appendix D.

Much of the material provided in this report, including the Net Pension Liability, is based on the results of the GASB 67 report for the Missouri State Employees' Retirement System, which was issued September 27, 2019. See the GASB 67 report for more information on the member data, actuarial assumptions and methods used in developing the Net Pension Liability and other GASB 67 results.

GASB 68 requires the inclusion of a proportionate share, as appropriate, of the Collective Net Pension Liability (NPL) on the participating employer's Statement of Net Position and a determination and proportionate share, as appropriate, of a Collective Pension Expense (PE) in the Notes to the Financial Statements that may bear little relationship to the employer's funding requirements. In fact, it is possible in some years for the NPL to be an asset or the PE to be an income item. The NPL is set equal to the Total Pension Liability (TPL) minus the Fiduciary Net Position (FNP). The benefit provisions recognized in the calculation of the TPL are summarized in Appendix B.

PE includes amounts for Service Cost (the Normal Cost under Entry Age Normal (EAN) for the year), interest on the TPL, employee contributions, administrative expenses, other cash flows during the year, recognition of increases/decreases in the TPL due to changes in the benefit structure, actual versus expected experience, and actuarial assumption changes, and recognition of investment gains/losses. The actual experience and assumption change impacts are recognized over the average expected remaining service life of the System membership as of the beginning of the measurement period, while investment gains/losses are recognized equally over five years. The development of the PE is shown in Section III.

The unrecognized portions of each year's experience, assumption changes and investment gains/losses are used to develop the Collective Deferred Outflows of Resources and Collective Deferred Inflows of Resources, the proportionate share of which, as appropriate, also must be included on the participating employer's Statement of Net Position.

Among the items needed for the TPL calculation is a discount rate, as defined by GASB, or a Single Equivalent Interest Rate (SEIR). To determine the SEIR, the FNP must be projected into the future for as long as there are anticipated benefits payable under the plan provisions applicable to the membership and

beneficiaries of the System on the Measurement Date. If the FNP is not projected to be depleted at any point in the future, the long-term expected rate of return on plan investments expected to be used to finance the benefit payments may be used as the SEIR.

If, however, the FNP is projected to be depleted at a future measurement date, the SEIR is determined as the single rate that will generate a present value of benefit payments equal to the sum of the present value determined by discounting all projected benefit payments through the date of depletion by the long-term expected rate of return, and the present value determined by discounting those benefits after the date of depletion by a 20-year tax-exempt municipal bond (rating AA/Aa or higher) rate. The rate used, if necessary, for this purpose is the monthly average of the Bond Buyers General Obligation 20-year Municipal Bond Index Rate (formerly published monthly by the Board of Governors of the Federal Reserve System).

Our calculations indicate that the FNP is not projected to be depleted, so the Municipal Bond Index Rate is not used in the determination of the SEIR for either the June 30, 2018 or the June 30, 2019 TPL. The SEIR for the Measurement Date is 7.10%, the long-term assumed rate of return on investments. The SEIR for the Prior Measurement Date was 7.25%.

The FNP projections are based on the System's financial status on the Measurement Date, the indicated set of methods and assumptions, and the requirements of GASB 67 and 68. As such, the FNP projections are not reflective of the cash flows and asset accumulations that would occur on an ongoing plan basis, reflecting the impact of future members. Therefore, the results of this test do not necessarily indicate whether or not the System will actually run out of money, the financial condition of the System, or the System's ability to make benefit payments in future years.

The sections that follow provide the results of all the required calculations, presented in the order set out in GASB 68 for note disclosure and Required Supplementary Information (RSI).

SECTION III – PENSION EXPENSE

As noted earlier, the Collective Pension Expense (PE) consists of a number of different items. GASB 68 refers to the first as Service Cost, which is the Normal Cost using the Entry Age Normal (EAN) actuarial funding method. The second item is interest on the TPL at 7.25%, the SEIR in effect as of the Prior Measurement Date.

The next three items refer to any changes that occurred in the TPL due to:

- benefit changes,
- actual versus expected experience, or
- changes in actuarial assumptions or other inputs.

Benefit changes, which are reflected immediately in PE, will increase PE if there is a benefit improvement for existing System members, or decrease PE if there is a benefit reduction. For the plan year ended June 30, 2019, there were no benefit changes to be recognized.

The next item to be recognized is the portion of current year change in the TPL due to actual versus expected System experience for the year. The portion to recognize in the current year is determined by spreading the total change over the average expected remaining service life of the entire System membership at the beginning of the measurement period. The average expected remaining service life of active members is the average number of years the active members are expected to remain in covered employment. At the beginning of the measurement period this number is 8.737 years. The average expected remaining service life of the inactive members is zero. Therefore, the recognition period is the weighted average of these two amounts, or 3.263 years.

The last item under changes in TPL is changes in actuarial assumptions or other inputs. There were a few changes in the actuarial assumptions or other inputs since the Prior Measurement Date. The biggest change was a decrease in the long-term rate of return from 7.25% to 7.10%. The other changes were decreases in price inflation, the payroll and wage growth assumptions and the cost-of-living adjustment assumption. These changes will be recognized over the average expected remaining service life of the entire System membership, using the same approach that applied to experience gains and losses, as described earlier.

Employee contributions for the year and projected earnings on the FNP (using the long-term expected rate of return) are subtracted from the amount determined thus far. One-fifth of the current-period difference between projected and actual earnings on the FNP is recognized in the PE.

The current year portions of previously determined experience, assumption changes and earnings amounts, recognized as Collective Deferred Outflows of Resources and Collective Deferred Inflows of Resources are included next. Collective Deferred Outflows of Resources are added to the PE while Collective Deferred Inflows of Resources are subtracted from the PE. Finally, administrative expenses and other miscellaneous items are included.

The calculation of the Collective PE for the year ended June 30, 2019 is shown in the following table.

Collective Pension Expense
For the Year Ended

June 30, 2019	
Service Cost at end of year	$158,190,866
Interest on the Total Pension Liability	956,725,536
Benefit term changes	0
Expensed portion of current-period difference between expected and actual experience in the Total Pension Liability	2,276,030
Expensed portion of current-period assumption changes	22,782,973
Employee contributions	(31,286,632)
Projected earnings on plan investments	(567,126,566)
Expensed portion of current-period differences between projected and actual earnings on plan investments	50,694,098
Administrative expenses	9,200,826
Other*	(5,416,384)
Recognition of beginning Deferred Outflows of Resources	693,430,571
Recognition of beginning Deferred Inflows of Resources	(61,840,514)
Total Pension Expense	**$1,227,630,804**

* Other includes ($1,529,873) in unallocated employer contributions, of which ($1,488,809) is from MOSERS.

Note: System experience and assumption changes are recognized over the average expected remaining service life for all System members, which is 3.263 years.

SECTION IV – NOTES TO FINANCIAL STATEMENTS

The material presented herein will follow the order presented in GASB 68. Paragraph numbers are provided for ease of reference. Amounts are shown in the aggregate, unless otherwise indicated.

Paragraph 76(a) – (d): The required information will be supplied by the Missouri State Employees' Retirement System.

Paragraph 77: This paragraph requires information to be disclosed regarding the actuarial assumptions and other inputs used to measure the TPL. The complete set of actuarial assumptions and other inputs utilized in developing the TPL are outlined in Appendix C. The TPL as of June 30, 2019 was determined based on an actuarial valuation prepared as of June 30, 2019, using the following key actuarial assumptions and other inputs:

Price Inflation	2.35 percent
Payroll Growth	2.35 percent
Salary increases, including wage inflation	2.85 to 8.35 percent; General Assembly is assumed to only get wage inflation of 2.60 percent
Long-term Rate of Return, net of investment expense, including price inflation	7.10 percent
Municipal Bond Index Rate	3.50 percent
Year FNP is Projected to be Depleted	N/A
Single Equivalent Interest Rate, net of investment expense, including price inflation	7.10 percent
Cost-of-living adjustment	4.00%, compounded annually, when a minimum COLA of 4.00% is in effect. 1.88%, compounded annually, when no minimum COLA is in effect (80% of price inflation).
Mortality	Pre-retirement mortality rates were based on the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 (scaled by 95% for males and 90% for females).

Post-retirement mortality rates were based on the RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%.

Disabled mortality rates were based on the RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 (scaled by 95% for males and 90% for females).

The demographic actuarial assumptions used in the valuation are based on the results of the most recent complete actuarial experience study, which covered the five-year period ending June 30, 2015. The experience study report, performed by the prior actuary, is dated March 28, 2016. The economic actuarial assumptions used in the valuation are based on the results of the most recent economic experience study, which was performed in July, 2018.

Paragraph 78

(a): Discount rate (SEIR). The discount rate used to measure the TPL at June 30, 2019 was 7.10%. The discount rate used to measure the TPL at the Prior Measurement Date was 7.25%.

(b): Projected cash flows. The projection of cash flows used to determine the discount rate assumed that plan contributions from members and the employers will be made at the contribution rates as set in state statute:

a. Employee contribution rate: 4.00% of salary for members hired on or after 1/1/2011; no contributions for members hired before 1/1/2011.
b. Employer contribution rate: The actuarial required contribution rate is determined as of the Prior Measurement Date (June 30, 2017 for FYE June 30, 2019) and is subject to a minimum employer contribution rate of 16.97% until the plan is at least 80% funded.
c. Administrative expenses in the prior year were projected forward with price inflation as an estimate for administrative expenses in the current and future years. The portion of expenses in future years allocated to the current members was based on the proportionate share of covered payroll in each year for the remainder of the existing members to the total covered payroll for all members.

Based on those assumptions, the System's FNP was projected to be available to make all projected future benefit payments of current System members. Therefore, the long-term expected rate of return on System investments of 7.10% was applied to all periods of projected benefit payments to determine the TPL.

The FNP projections are based on the System's financial status on the Measurement Date, the indicated set of methods and assumptions, and the requirements of GASB 67 and 68. As such, the FNP projections are not reflective of the cash flows and asset accumulations that would occur on an ongoing plan basis, reflecting the impact of future members. Therefore, the results of this test

do not necessarily indicate whether or not the System will actually run out of money, the financial condition of the System, or the System's ability to make benefit payments in future years.

(c): Long-term rate of return. The long-term expected rate of return on pension plan investments is reviewed regularly as part of the experience study. The most recent economic experience analysis was performed and results provided in July, 2018. Generally, several factors are considered in evaluating the long-term rate of return assumption including long-term historical data, estimates inherent in current market data, and an analysis in which best-estimate ranges of expected future real rates of return (expected returns, net of investment expense and inflation), along with estimates of variability and correlations for each asset class, were developed by the System's investment consultant. These ranges were combined to develop the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and then adding expected inflation. The capital market assumptions developed by investment consultants are often intended for use over a 10-year investment horizon and are not always useful in setting the long-term rate of return for funding pension plans which covers a longer timeframe.

(d): Municipal bond rate. A municipal bond rate was not used in determining the discount rate. If it were required, the rate would be 3.50% on the Measurement Date.

(e): Period of projected benefit payments. Projected future benefit payments for all current plan members were projected through 2118.

(f): Assumed asset allocation. The target asset allocation and best estimates of real rates of return for each major asset class will be supplied by the System.

(g): Sensitivity analysis. This paragraph requires disclosure of the sensitivity of the NPL to changes in the discount rate. The following presents the NPL of the System, calculated using the discount rate of 7.10 percent, as well as the System's NPL calculated using a discount rate that is 1-percentage-point lower (6.10 percent) or 1-percentage-point higher (8.10 percent) than the current rate:

	1% Decrease (6.10%)	Current Discount Rate (7.10%)	1% Increase (8.10%)
Total Pension Liability	$15,537,678,637	$13,957,626,309	$12,629,186,581
Fiduciary Net Position	7,916,465,279	7,916,465,279	7,916,465,279
Net Pension Liability	$7,621,213,358	$6,041,161,030	$4,712,721,302

Paragraph 79: The required information will be supplied by the Missouri State Employees' Retirement System.

Paragraph 80:

(a)-(b): This information for each participating employer is provided in Appendix D of this report.

(c): The Measurement Date of the Collective NPL is June 30, 2019. The TPL as of June 30, 2019 was determined based on the annual actuarial funding valuation report prepared as of June 30, 2019.

(d): There were a few changes in the actuarial assumptions or other inputs since the Prior Measurement Date. The biggest change was a decrease in the long-term rate of return from 7.25% to 7.10%. The other changes were decreases in the price inflation, payroll and wage growth assumptions and the cost-of-living adjustment assumption.

(e): There were no changes to the benefit provisions since the Prior Measurement Date.

(f): The information will be supplied by employers participating in the Missouri State Employees' Retirement System.

(g): Please see Section III for the development of the Collective PE. The proportionate share of Collective PE for each participating employer is provided in Appendix D.

(h)(1)-(3): Since certain expense items are recognized over closed periods each year, the deferred portions of these items must be tracked annually. If the amounts will increase PE, then they are labeled Deferred Outflows of Resources. If the amounts serve to reduce PE they are labeled Deferred Inflows of Resources. The recognition of these amounts is accomplished on a level dollar basis, with no interest included in the deferred amounts. Experience gains/losses and the impact of changes in actuarial assumptions or other inputs, if any, are recognized over the average expected remaining service life of the active and inactive System members at the beginning of the measurement period. The difference between projected and actual earnings is recognized over a fixed five-year period.

The following tables provide the amounts of the Collective Deferred Outflows of Resources and Collective Deferred Inflows of Resources as of the Measurement Date (June 30, 2019) for the System. Per GASB 68, reporting of the differences between projected and actual earnings should be on a net basis, with only one Deferred Outflow or Inflow. This information is provided in the following table. Detail by participating employer is provided in Appendix D of this report.

	Deferred Outflows of Resources	Deferred Inflows of Resources	Net Deferred Outflows/(Inflows) of Resources
Differences between expected and actual experience	$5,150,655	$70,225,426	($65,074,771)
Changes of assumptions	241,387,365	0	241,387,365
Differences between projected and actual earnings	469,036,711	0	469,036,711
Changes in proportion	28,949,719	28,949,719	0
Total	$744,524,450	$99,175,145	$645,349,305

The following tables show the Collective Deferred Outflows of Resources and Collective Deferred Inflows of Resources separately to provide additional detail. Detail by participating employer is provided in Appendix D of this report.

Deferred Outflows of Resources	June 30, 2018	Additions	Recognition	June 30, 2019
Differences between expected and actual experience				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	12,695,184	0	12,695,184	0
2017 Base	0	0	0	0
2018 Base	0	0	0	0
2019 Base	0	7,426,685	2,276,030	5,150,655
Total	$ 12,695,184	$ 7,426,685	$ 14,971,214	$ 5,150,655
Changes of assumptions				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	136,357,315	0	136,357,315	0
2017 Base	91,565,862	0	55,494,462	36,071,400
2018 Base	252,829,035	0	99,070,938	153,758,097
2019 Base	0	74,340,841	22,782,973	51,557,868
Total	$ 480,752,212	$ 74,340,841	$ 313,705,688	$ 241,387,365
Differences between projected and actual earnings				
2015 Base	$ 190,538,164	$ 0	$ 190,538,164	$ 0
2016 Base	265,289,106	0	132,644,553	132,644,553
2017 Base	198,822,302	0	66,274,100	132,548,202
2018 Base	1,423,419	0	355,855	1,067,564
2019 Base	0	253,470,490	50,694,098	202,776,392
Total	$ 656,072,991	$ 253,470,490	$ 440,506,770	$ 469,036,711
Changes in proportion				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	1,102,782	0	1,102,782	0
2017 Base	1,558,259	0	944,401	613,858
2018 Base	19,672,204	0	7,708,544	11,963,660
2019 Base	0	23,606,935	7,234,734	16,372,201
Total	$ 22,333,245	$ 23,606,935	$ 16,990,461	$ 28,949,719
Total	$ 1,171,853,632	$ 358,844,951	$ 786,174,133	$ 744,524,450

Deferred Inflows of Resources				
	June 30, 2018	Additions	Recognition	June 30, 2019
Differences between expected and actual experience				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	0	0	0	0
2017 Base	47,105,584	0	28,548,838	18,556,746
2018 Base	84,960,356	0	33,291,676	51,668,680
2019 Base	0	0	0	0
Total	$ 132,065,940	$ 0	$ 61,840,514	$ 70,225,426
Changes of assumptions				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	0	0	0	0
2017 Base	0	0	0	0
2018 Base	0	0	0	0
2019 Base	0	0	0	0
Total	$ 0	$ 0	$ 0	$ 0
Differences between projected and actual earnings				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	0	0	0	0
2017 Base	0	0	0	0
2018 Base	0	0	0	0
2019 Base	0	0	0	0
Total	$ 0	$ 0	$ 0	$ 0
Changes in proportion				
2015 Base	$ 0	$ 0	$ 0	$ 0
2016 Base	1,102,782	0	1,102,782	0
2017 Base	1,558,259	0	944,401	613,858
2018 Base	19,672,204	0	7,708,544	11,963,660
2019 Base	0	23,606,935	7,234,734	16,372,201
Total	$ 22,333,245	$ 23,606,935	$ 16,990,461	$ 28,949,719
Total	$ 154,399,185	$ 23,606,935	$ 78,830,975	$ 99,175,145

(h)(4): Changes in each employer's proportionate share are shown on Exhibit 2 in Appendix D. The determination of proportionate share is based on individual employer contribution information, provided by the Missouri State Employees' Retirement System (see Exhibit 1 in Appendix D).

(h)(5): Employer contributions subsequent to the Measurement Date are considered Deferred Outflows of Resources. These amounts, if any, will be provided by each participating employer.

(i): The following table provides the Collective Deferred Outflows of Resources and Collective Deferred Inflows of Resources as of the Measurement Date (June 30, 2019) for the System that will be recognized in PE in future years. **These amounts do not reflect the deferred recognition of changes in proportionate share, recognition of actual contributions that differ from the proportionate share, or employer contributions subsequent to the Measurement Period.**

Appendix D contains the schedule, by participating employer, of the recognition of all amounts except for employer contributions subsequent to the Measurement Date.

Year Ending June 30:	Deferred Outflows of Resources	Deferred Inflows of Resources	Net Deferred Outflows/(Inflows) of Resources
2020	$410,169,947	$51,848,422	$358,321,525
2021	197,070,217	18,377,004	178,693,213
2022	57,640,469	0	57,640,469
2023	50,694,098	0	50,694,098
2024	0	0	0
Thereafter	0	0	0

(j): There were no contributions by non-employer contributing entities during the measurement period.

SECTION V – REQUIRED SUPPLEMENTARY INFORMATION

There are several tables of Required Supplementary Information (RSI) that need to be included in the System's financial statements:

Paragraphs 81(a): Information under 81(a)(1) (a)-(b), which is determined as of the Measurement Date of the Collective NPL, is provided in Appendix D of this report.

Paragraphs 81(b): This information is to be determined as of the employer's most recent fiscal year-end. Therefore, each participating employer should have the information available to populate the Schedule of Employer Contributions.

Paragraph 82: Information about factors that significantly affect trends in the amounts reported in the schedules required by paragraph 81 should be presented as notes to the schedules. At this point, only six years are being reported, but comments on additional years will be added as they occur.

Changes of benefit and funding terms: The following changes to the plan provisions were made by the Missouri General Assembly and reflected in the valuation performed as of June 30 listed below:

2019: None

2018: Legislation passed in the 2017 session allowed the MOSERS Board of Trustees to establish a voluntary buyout program prior to May 31, 2018 for terminated vested members (those who left state employment with a vested retirement benefit but prior to reaching retirement eligibility). The Board parameters for the buyout provided that eligible terminated vested members could elect to cash out their future monthly retirement benefit in exchange for a one-time lump sum payment equal to 60% of the actuarial present value of their retirement benefit amount.

2017: Senate Bill 62 (SB 62) made the following changes to the MSEP 2011 benefit provisions:

- Active members are now vested after 5 years of service (previously 10 years of service).
- Active members are now eligible for Normal Retirement at age 67 with 5 years of service (previously age 67 with 10 years of service).
- Active members are now eligible for Early Retirement at age 62 with 5 years of service (previously age 62 with 10 years of service).
- Cost-of-living adjustments for vested former members now commence on the second anniversary of the date of retirement (previously commenced on first anniversary).
- Service credit for unused sick leave is only applied for members who terminate service at their early or normal retirement date.

- Survivor benefits for terminated vested members start at the date the member would have been eligible for normal retirement, not at date of death.

2016: None

2015: None

2014: None

Changes in actuarial assumptions and methods:

6/30/2019 valuation:

- The investment return assumption was lowered from 7.25% to 7.10%.
- The price inflation assumption was lowered from 2.50% to 2.35%.
- The payroll growth assumption was lowered from 2.50% to 2.35%.
- The wage growth assumption was lowered from 2.75% to 2.60%.
- The cost-of-living adjustment (COLA) assumption was lowered from 2.00% to 1.88% when no minimum COLA is in effect (80% of price inflation).

6/30/2018 valuation:

- The investment return assumption was lowered from 7.50% to 7.25%.
- The payroll growth assumption was lowered from 3.00% to 2.50%.
- The wage growth assumption was lowered from 3.00% to 2.75%.
- The asset smoothing method was changed from an open 5-year smoothing method to a closed 5-year smoothing method, with the difference between the actual investment return and the expected investment return on the market value of assets recognized evenly over a closed 5-year period. Due to the change in the asset smoothing method, a transitional plan was necessary. This transitional plan recognizes the unrecognized investment experience as of June 30, 2017 evenly over a closed 7-year period.
- The Unfunded Actuarially Accrued Liability (UAAL) amortization method was changed from one base over a closed 30-year period that began June 30, 2014 to a "layered" approach first effective June 30, 2018. The "Legacy UAAL", as determined in the June 30, 2018 valuation, is amortized over a closed 30-year period. Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System's benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases.

6/30/2017 valuation:

- The investment return assumption was lowered from 7.65% to 7.50%.

6/30/2016 valuation:

- The long-term rate of return was lowered from 8.00% to 7.65%.
- Salary increases were changed from age based with increases between 3.2% and 5.9% to service based with increase between 3.25% and 8.75%.
- Post-retirement mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA to the RP-2014 healthy annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%.
- Pre-retirement mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA and scaled by 100% for males and 80% for females to the RP-2014 employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females.
- The disabled mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA and set forward 10 years to the RP-2014 disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females.
- Retirement rates were changed to better reflect actual experience of the System.
- The assumption for service credit for unused leave upon retirement and military service purchases was changed from 6 months to 8 months (4 months to 5 months for 2011 plan members).
- Withdrawal rates were changed to better reflect actual experience of the System.
- Disability rates were changed to better reflect actual experience of the System.
- Pre-retirement survivor benefits for spouse of terminated vested member liability loads were reduced.
- The marriage assumption at retirement was reduced from 75% to 70%.
- The marriage assumption for in-service deaths was reduced from 70% to 60%.
- The asset smoothing period changed from an open 3-year period to an open 5-year period.

6/30/2015 valuation:

- For the 2015 valuation only, the wage inflation was assumed to be 0% in the first year and 3% thereafter.

6/30/2014 valuation:

- The unfunded actuarial accrued liability amortization method was changed from a level percentage of payroll amortized over an open 30-year period to a level percentage of payroll amortized over a closed 30-year period beginning with the 6/30/2014 valuation.

APPENDIX A

ADDITIONAL INFORMATION

SCHEDULE OF CHANGES IN THE NET PENSION LIABILITY

Measurement Period Ended June 30, 2019

	Total Pension Liability (a)	Plan Fiduciary Net Position (b)	Net Pension Liability (a) – (b)
Balances at June 30, 2018	$13,612,763,961	$8,034,508,424	$5,578,255,537
Changes for the year:			
Service Cost at end of year	158,190,866		158,190,866
Interest on TPL	956,725,536		956,725,536
Benefit term changes	0		0
Differences between expected and actual experience	7,426,685		7,426,685
Assumption changes	74,340,841		74,340,841
Employer contributions		394,150,042	(394,150,042)
Non-employer contributions		0	0
Employee contributions		31,286,632	(31,286,632)
Net investment income		313,656,076	(313,656,076)
Benefit payments, including member refunds	(851,821,580)	(851,821,580)	0
Administrative expenses		(9,200,826)	9,200,826
Other		3,886,511	(3,886,511)
Net changes	344,862,348	(118,043,145)	462,905,493
Balances at June 30, 2019	$13,957,626,309	$7,916,465,279	$6,041,161,030

APPENDIX B

SUMMARY OF PLAN PROVISIONS

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
DEFINITIONS		
Participants		
All MOSERS members, vested former members, retirees and survivors who first became members prior to July 1, 2000 and who do **not** elect to transfer to the MSEP 2000 plan. Election is made at the time benefits commence.	(1) All new employees who first become members on or after July 1, 2000, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP). (2) MSEP active members and vested former members who elect to transfer to the MSEP 2000 plan prior to retirement. (3) MSEP retirees who elect to transfer to the MSEP 2000 plan during the election window from July 1, 2000 through June 30, 2001, and their survivors. (4) MSEP non-vested terminations rehired on or after July 1, 2000. (5) Members hired prior to January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.	(1) All new employees who first become employees on or after January 1, 2011, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP). (2) Members hired on or after January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Final average earnings		
The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).	The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).	The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).
Member contributions		
None.	Same as MSEP.	4.0% of salary, with interest credited to member contributions based on the 52-week Treasury bill rate (4% prior to June 30, 2014).

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
ELIGIBILITY FOR BENEFITS **Normal retirement** *Members of the General Assembly:* Age 55 with completion of at least 3 full biennial assemblies. *Statewide Elected Officials:* The earliest of attaining: (1) Age 65 with at least 4 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 50 with age plus credited service equal to 80 or more. *General Employees:* The earliest of attaining: (1) Age 65 and active with at least 4 years of credited service. (2) Age 65 with at least 5 years of credited service. (3) Age 60 with at least 15 years of credited service. (4) Age 48 with age plus credited service equal to 80 or more.	*Members of the General Assembly:* The earliest of attaining: (1) Age 55 with completion of at least 3 full biennial assemblies. (2) Age 50 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 80 or more. *Statewide Elected Officials:* The earliest of attaining: (1) Age 55 with at least 4 years of credited service. (2) Age 50 with age plus credited service equal to 80 or more. *General Employees:* The earliest of attaining: (1) Age 62 with at least 5 years of credited service. (2) Age 48 with age plus credited service equal to 80 or more.	*Members of the General Assembly:* The earliest of attaining: (1) Age 62 with completion of at least 3 full biennial assemblies. (2) Age 55 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 90 or more. *Statewide Elected Officials:* The earliest of attaining: (1) Age 62 with at least 4 years of credited service as a statewide elected official. (2) Age 55 with age plus credited service equal to 90 or more. *General Employees:* The earliest of attaining: (1) Age 67 with at least 5 years of credited service. (2) Age 55 with age plus credited service equal to 90 or more.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Uniformed Water Patrol Employees: The earliest of attaining: (1) Age 55 and active with at least 4 years of credited service. (2) Age 55 with at least 5 years of credited service. (3) Age 48 with age plus credited service equal to 80 or more. *Administrative Law Judges:* The earliest of attaining: (1) Age 62 and active with at least 12 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 55 with at least 20 years of credited service.		
Early retirement for general employees		
Age 55 with at least 10 years of credited service.	Age 57 with at least 5 years of credited service.	Age 62 with at least 5 years of credited service.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
MONTHLY BENEFITS PAYABLE **Normal Retirement** *Members of the General Assembly:* $150 per month per biennial assembly served. *Statewide Elected Officials:* 1) Less than 12 years of credited service: 1.6% of Average Compensation times years of credited service. 2) 12 or more years of credited service: 50% of pay of the highest elected position held prior to retirement. *General Employees:* 1.6% of Average Compensation times years of credited service. 2.1% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System. *Uniformed Water Patrol:* 2.13% of Average Compensation times years of credited service.	*Members of the General Assembly:* 1/24 of pay times first 24 years of credited service as a member of the General Assembly. *Statewide Elected Officials:* 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official. *General Employees:* 1.7% of Average Compensation times years of credited service. Temporary Benefit: If member retires between ages 48 and 62 with age plus credited service equal to 80 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.	*Members of the General Assembly:* 1/24 of pay times first 24 years of credited service as a member of the General Assembly. *Statewide Elected Officials:* 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official. *General Employees:* 1.7% of Average Compensation times years of credited service. Temporary Benefit: If member retires between ages 55 and 62 with age plus credited service equal to 90 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Administrative Law Judges: 50% of Compensation	Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.	Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.
Early retirement for general employees		
Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement. 1) Less than 15 years of service: Normal retirement amount actuarially reduced for years younger than age 65. 2) 15 years but less than 20 years of service, and less than the number of years of service necessary for age and service to total 80: Normal retirement amount actuarially reduced for years younger than age 60. 3) 20 or more years of service, but less than the number of years of service necessary for age and service to total 80: Normal retirement amount reduced for years younger than the 80 and out eligibility date.	Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 62.	Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 67.

<table>
<tr><th>MSEP
(Missouri State Employees' Plan)</th><th>MSEP 2000
(Missouri State Employees' Plan 2000)</th><th>MSEP 2011
(Missouri State Employees' Plan 2011)</th></tr>
<tr><td>Vested deferred benefits</td><td></td><td></td></tr>
<tr><td>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at the age the individual would have been eligible for early or normal retirement, considering years of credited service). Unused sick leave is not converted.</td><td>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 57 for early retirement or 62 for normal retirement). Unused sick leave is not converted. CURP to MOSERS transfers with 6 years of service are immediately vested.</td><td>Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 67 normal retirement). Unused sick leave is not converted.</td></tr>
<tr><td><table>
<tr><th>Years of Service</th><th>General Assembly</th><th>Elected Officials</th><th>General Employees</th></tr>
<tr><td>4</td><td></td><td>100%</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td>100%</td></tr>
<tr><td>6*</td><td>100%</td><td></td><td></td></tr>
</table>
*3 Assemblies</td><td><table>
<tr><th>Years of Service</th><th>General Assembly</th><th>Elected Officials</th><th>General Employees</th></tr>
<tr><td>4</td><td></td><td>100%</td><td></td></tr>
<tr><td>5</td><td></td><td></td><td>100%</td></tr>
<tr><td>6*</td><td>100%</td><td></td><td></td></tr>
</table>
*3 Assemblies, HB1455 prospectively</td><td><table>
<tr><th>Years of Service</th><th>General Assembly</th><th>Elected Officials</th><th>General Employees</th></tr>
<tr><td>4</td><td></td><td>100%</td><td></td></tr>
<tr><td>6*</td><td>100%</td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td>100%</td></tr>
</table>
*3 Assemblies, HB1455 prospectively</td></tr>
<tr><td>Death prior to retirement</td><td></td><td></td></tr>
<tr><td>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service and was married on the date of death. If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived and the minimum</td><td>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (3 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived</td><td>The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (2 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived</td></tr>
</table>

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).	and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).	and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).
Death after retirement		
50% of the benefit the retired member was receiving on the date of death (the normal form of payment), or the benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement and provided the member was married on their date of retirement. Effective July 1, 2000, a member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).	The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).	The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary upon completion of one year of marriage. Additionally, a member may designate a new spouse as beneficiary upon completion of one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).

<table>
<tr><th>MSEP
(Missouri State Employees' Plan)</th><th>MSEP 2000
(Missouri State Employees' Plan 2000)</th><th>MSEP 2011
(Missouri State Employees' Plan 2011)</th></tr>
<tr><td>Disability</td><td></td><td></td></tr>
<tr><td>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability (if the member retires on or after August 28, 1999, the member's rate of pay is based on the rate of pay at the time of disability indexed to the time of benefit commencement). An exception is Uniformed Water Patrol employees who are eligible for an immediate occupational disability benefit equal to 50% of pay at time of disability.</td><td>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.</td><td>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.</td></tr>
<tr><td>Post-retirement benefit adjustments</td><td></td><td></td></tr>
<tr><td>Benefits are increased to retired members (including survivors) annually in accordance with the following formulas:
<table>
<tr><th>Increase in CPI</th><th>Formula 1 Benefit Increase</th><th>Formula 2 Benefit Increase</th></tr>
<tr><td>5.00% or less</td><td>4%</td><td>80% of CPI increase</td></tr>
<tr><td>5.01% - 6.24%</td><td>80% of CPI increase</td><td>80% of CPI increase</td></tr>
<tr><td>6.25% or more</td><td>5%</td><td>5%</td></tr>
</table></td><td>Benefits are increased to retired members (including survivors) annually in accordance with the following:

Members of the General Assembly:
Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</td><td>Benefits are increased to retired members (including survivors) annually in accordance with the following:

Members of the General Assembly:
Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</td></tr>
</table>

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Members first hired prior to August 28, 1997 receive COLAs based on Formula 1 until an aggregate increase of 65% is reached. At that point subsequent COLAs based on Formula 2 are granted. Members first hired on or after August 28, 1997 receive COLAs based solely on Formula 2. Statewide Elected Officials with 12 or more years of service have their benefit adjusted annually based on the increase in the pay for an active statewide elected official in the member's highest elected position. Members who are fully vested and work beyond age 65 will have their monthly benefit increased upon retirement. The percentage increase in benefit is equal to all COLAs for the years between age 65 and date of retirement, not to exceed 65% and counts toward the Formula 1 65% maximum.	*Statewide Elected Officials:* Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position. *General Employees:* Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%. CPI: For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years determination of CPI. Timing of Increase: Benefits are adjusted on the anniversary of the effective date of retirement for most members. Members retiring under the BackDROP provisions have an anniversary based on the retroactive starting date for the BackDROP.	*Statewide Elected Officials:* Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position. *General Employees:* Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%. CPI: For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years determination of CPI. Timing of Increase: Benefits are adjusted on the anniversary of the effective date of retirement. For inactive vested General Employees who enter retirement, the first COLA will not be granted until the second anniversary of the effective date of retirement.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Pop-up provision		
Benefits to members who choose a survivor form of payment and whose spouse precedes the member in death, will "pop-up" or revert to the amount the member would have received had he/she not elected a survivor option.	Same.	Same.
Portability		
Purchase/Transfer Provisions (in addition to military). Effective August 28, 1999, a member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service.	Purchase/Transfer Provisions (in addition to military). A member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service. Local vested service credit granted after 10 years of state service if the other retirement plan agrees to transfer assets equal to the accrued liability to MOSERS.	May purchase qualifying public sector service at full actuarial cost.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
BackDROP		
To be eligible to participate in the BackDROP, a member must have been eligible to retire under normal retirement age and/or service conditions for at least two years. A retroactive starting date is established for BackDROP purposes which is the later of: 1) the member's normal retirement date or 2) five years prior to the annuity starting date under the retirement plan selected by the member.	Same as MSEP.	Not eligible for the BackDROP.
A member may elect the BackDROP period for the accumulation of the BackDROP account in 12 month increments prior to their actual retirement date or back to the earliest possible date. This results in a BackDROP period of one to five years depending upon the individual situation.		
A theoretical BackDROP account is accumulated that includes 90% of the value of the benefit payments that would have been paid during the BackDROP period had the member retired at the retroactive starting date with their respective option election. These payments include applicable post-retirement benefit increases.		

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
The member is paid the resulting lump sum value of the BackDROP account as of the annuity starting date or as three equal annual installments beginning at the annuity starting date. The annuity benefit payable from the actual retirement date is computed with years of service and average pay as of the retroactive starting date for the BackDROP. Post-retirement benefit increases that occurred during the BackDROP period are applied in the calculation of the monthly annuity.		

APPENDIX C

STATEMENT OF ACTUARIAL ASSUMPTIONS

ACTUARIAL ASSUMPTIONS

Economic Assumptions

1. Investment Return — 7.10%, compounded annually, net of investment expenses.

   Note: This assumption will change to 6.95% for the June 30, 2020 valuation and thereafter, absent Board action.

2. Inflation — 2.35% per year

   Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

3. Salary Increases — Rates vary by service. Sample rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
1	2.35%	0.25%	5.75%	8.35 %
2	2.35	0.25	2.50	5.10
3	2.35	0.25	1.50	4.10
4	2.35	0.25	1.25	3.85
5	2.35	0.25	1.00	3.60
9	2.35	0.25	0.75	3.35
10	2.35	0.25	0.50	3.10
21+	2.35	0.25	0.25	2.85

4. Payroll Growth — 2.35% per year

   Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

5. Cost-of-Living Adjustment (COLA) — 4.00% on a compounded basis when a minimum COLA of 4.00% is in effect.

   1.88% on a compounded basis when no minimum COLA is in effect.

   Note: This assumption will change to 1.80% for the June 30, 2020 valuation and thereafter, absent Board action.

6. Interest on Member Contributions — 1.50% per year

7. Administrative Expenses — Actual prior year expenses, included in normal cost rate.

Demographic Assumptions

1. Mortality — The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

   a. Post-retirement — RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%

   b. Pre-retirement — RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females

   c. Long-term disability — RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females

2. Retirement Assumption

	Normal Retirement				Early Retirement		
	MSEP and MSEP 2000*			MSEP 2011**		MSEP and MSEP 2000	MSEP 2011
Retirement Age	Percent Retiring 1st Year	Percent Retiring 2nd Year	Percent Retiring 3rd Year	Percent Retiring	Retirement Age	Percent Retiring	Percent Retiring
48	20 %						
49	20	10 %					
50	20	10	21 %				
51	20	10	21				
52	20	10	21				
53	20	10	21				
54	20	10	21				
55	20	10	21	45 %			
56	20	10	21	45			
57	20	10	21	35	57	2.4 %	
58	20	10	21	35	58	3.1	
59	20	10	21	30	59	3.0	
60	20	10	21	35	60	5.1	
61	19	10	21	25	61	6.0	
62	18	22	29	40	62	6.0	10 %
63	16	18	24	30	63	6.0	10
64	15	17	17	20	64	6.0	10
65	19	19	27	30	65		50
66	24	25	28	25	66		50
67	10	25	23	20	67		
68	20	25	23	20	68		
69	20	25	23	20	69		
70	20	25	23	20	70		
71	20	25	23	20	71		
72	20	25	23	20	72		
73	20	25	23	20	73		
74	20	25	23	20	74		
75	50	50	23	50	75		
76	50	50	23	50	76		
77	75	75	23	75	77		
78	100	100	100	100	78		

** For members hired prior to January 1, 2011.*
*** For members hired on or after January 1, 2011.*

3. Termination From Active Employment

Sample Age	Years of Service	Percent of Active Members Separating within the Next Year: Termination** Males	Termination** Females	Death* Males	Death* Females	Disability Males	Disability Females
	0-1	24.0 %	27.5 %				
	1-2	19.0	21.5				
	2-3	15.5	16.3				
	3-4	13.3	13.5				
	4-5	11.2	11.3				
25	5+	13.5 %	14.0 %	0.03 %	0.01%	0.10 %	0.10 %
30		10.6	11.0	0.03	0.02	0.10	0.10
35		8.2	8.5	0.04	0.03	0.10	0.10
40		5.8	6.0	0.05	0.03	0.36	0.36
45		4.3	4.5	0.07	0.05	0.41	0.41
50		2.9	3.0	0.13	0.08	0.57	0.57
55		2.9	3.0	0.22	0.14	0.77	0.77
60		2.9	3.0	0.40	0.20	1.02	1.02
65		2.9	3.0	0.70	0.30	1.23	1.23
70		2.9	3.0	1.17	0.50	1.23	1.23

** The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females. 2% of the deaths in active service are assumed to be duty related.*

*** Does not apply to Elected Officials and Legislators.*

Elected Officials and Legislators

Years of Service	Percent of Active Members Separating within the Next Year: Termination Male/Female
0-1	8.0 %
1-2	8.0
2-3	8.0
3-4	8.0
4-5	12.0
5-6	12.0
6-7	12.0
7+	35.0

Other Assumptions

1. Form of Payment — MSEP – 50% joint and survivor
MSEP 2000 and MSEP 2011 – Straight life annuity

2. Marital Status

   a. Percent married — 70% married at retirement, 60% of those dying in active service are married

   b. Spouse's age — Females assumed to be three years younger than males.

3. Pay Increase Timing — Beginning of the fiscal year.

4. Decrement Timing — Decrements of all types are assumed to occur mid-year.

5. Eligibility Testing — Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

6. Benefit Service — Exact fractional service is used to determine the amount of the benefit payable.

7. Decrement Relativity — Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

8. Decrement Operation — Disability and withdrawal do not operate during normal retirement eligibility.

9. Other Liability Adjustments — Pre-Retirement Survivor Benefits for Spouse of Terminated Vested Member

Age	Male/Female
<30	1.57/1.31
30-39	1.24/1.13
40-49	1.09/1.05
>50	1.02/1.01

These factors are used to estimate the cost of immediate unreduced survivor annuities upon the death of a vested member.

10. Incidence of Contributions — Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made. New entrant normal cost

	contributions are applied to the funding of new entrant benefits.
11. MSEP 2000 Election	All regular state employees hired on or before June 30, 2000 are assumed to elect MSEP 2000 prior to age 62 and MSEP on or after age 62. Elected Officials, General Assembly, and Uniformed Water Patrol Members hired before July 1, 2000 are assumed to elect MSEP at retirement.
12. Service Adjustment	It is assumed that each member will be granted 8 months of service credit, 4 months for unused leave upon retirement and 4 months for military service purchases. For members hired on or after January 1, 2011 it is assumed that each member will be granted 5 months for unused leave.
13. Forfeitures	MSEP - For those hired on or after January 1, 2011, 50% of state employees terminating at first vesting eligibility are assumed to take a refund and forfeit their deferred pension. This percentage decreases to 0% at first retirement eligibility.
14. Salary and Benefit Limits	For purposes of the valuation, no limits were applied to member compensation or benefits.
15. Commencement age for deferred vested benefit	Normal Retirement Date

Data Adjustments

Active and retired member data was reported as of May 31, 2019. It was brought forward to June 30, 2019 by adding one month of service for all active members, one month of contributions and interest for MSEP 2011 members, and the June COLA for certain retired members. Financial information continues to be reported as of June 30. This procedure was instituted to provide sufficient time for the Board of Trustees to certify the appropriate contribution rate prior to the October 1 statutory deadline.

Active members reported with less than a $100 annualized salary were assumed to receive the average active member pay.

When the option of choosing plans is available, terminated vested members are reported with two records, one with benefits under the MSEP plan and one with benefits under the MSEP 2000 plan. Because it is unknown what the member will elect at retirement, both records are valued and the plan that produces the higher present value of future benefits is used for valuation purposes.

For any retired member who has elected a joint and survivor benefit yet has no beneficiary date of birth provided, it was assumed that the beneficiary is 3 years younger for male retirees and 3 years older for female retirees.

For members reported with no gender, the member is assumed to be male.

Due to limitations in our valuation program, members who are not eligible for normal retirement prior to age 85 had their date of birth adjusted.

TECHNICAL VALUATION PROCEDURES

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.

APPENDIX D

DETAILED INFORMATION FOR PARTICIPATING EMPLOYERS

Exhibit 1

Missouri State Employees' Retirement System

Schedule of Employer Allocations

For the Years Ended 6/30/2018 and 6/30/2019

Entity	Year Ended June 30, 2018 Employer Contributions	Year Ended June 30, 2018 Employer Allocated Proportion	Year Ended June 30, 2019 Employer Contributions	Year Ended June 30, 2019 Employer Allocated Proportion
Total	$378,047,057		$392,620,169	
State of Missouri	312,600,744	82.688314%	326,370,414	83.126249%
Environmental Improvement & Energy Resource Authority	60,519	0.016008%	29,444	0.007499%
Missouri Agriculture & Small Business Development Authority	32,659	0.008639%	37,150	0.009462%
Missouri Consolidated Health Care Plan (MCHCP)	566,720	0.149907%	580,484	0.147849%
Missouri Development Finance Board	97,293	0.025736%	103,172	0.026278%
Missouri Housing Development Commission	1,131,676	0.299348%	1,125,887	0.286762%
Missouri Public Entity Risk Management Fund	113,588	0.030046%	127,449	0.032461%
Missouri Technology Corporation	40,575	0.010733%	29,309	0.007465%
Missouri Wine and Grape Board	53,617	0.014183%	54,145	0.013791%
Harris Stowe State University	1,626,633	0.430273%	1,758,900	0.447990%
Lincoln University	2,811,886	0.743793%	2,937,435	0.748162%
Missouri Southern State University	3,741,459	0.989681%	3,929,618	1.000870%
Missouri State University	18,841,875	4.984003%	19,482,117	4.962077%
Missouri Western State University	4,033,057	1.066813%	4,151,724	1.057440%
Northwest Missouri State University	5,720,472	1.513164%	6,029,695	1.535758%
Southeast Missouri State University	8,737,295	2.311166%	8,330,406	2.121747%
State Technical College of Missouri	1,703,518	0.450610%	1,847,794	0.470631%
Truman State University	6,049,390	1.600169%	6,221,531	1.584618%
University of Central Missouri	10,084,081	2.667414%	9,473,495	2.412891%

Exhibit 2

Missouri State Employees' Retirement System

Schedule of Deferred Resources

Measurement Date: 6/30/2019

Entity	6/30/18 Net Pension Liability (NPL)	6/30/19 Net Pension Liability (NPL)	Deferred Outflows of Resources: Differences Between Expected and Actual Experience	Deferred Outflows of Resources: Net Difference Between Projected and Actual Earnings on Pension Plan Investments	Deferred Outflows of Resources: Changes of Assumptions	Deferred Outflows of Resources: Changes in Proportion	Deferred Outflows of Resources: Total Deferred Outflows of Resources	Deferred Inflows of Resources: Differences Between Expected and Actual Experience	Deferred Inflows of Resources: Net Difference Between Projected and Actual Earnings on Pension Plan Investments	Deferred Inflows of Resources: Changes of Assumptions	Deferred Inflows of Resources: Changes in Proportion	Deferred Inflows of Resources: Total Deferred Inflows of Resources
Total	$5,578,255,537	$6,041,161,030	$5,150,655	$469,036,711	$241,387,365	$28,949,719	$744,524,450	$70,225,426	$0	$0	$28,949,719	$99,175,145
State of Missouri	4,612,565,456	5,021,790,560	4,281,549	389,892,624	200,656,259	25,137,563	619,967,995	58,375,760	0	0	139,124	58,514,884
Environmental Improvement & Energy Resource Authority	892,967	453,027	386	35,173	18,102	0	53,661	5,266	0	0	307,635	312,901
Missouri Agriculture & Small Business Development Authority	481,905	571,615	487	44,380	22,840	26,032	93,739	6,645	0	0	25,290	31,935
Missouri Consolidated Health Care Plan (MCHCP)	8,362,196	8,931,796	7,615	693,466	356,889	0	1,057,970	103,828	0	0	142,403	246,231
Missouri Development Finance Board	1,435,620	1,587,496	1,353	123,253	63,432	29,921	217,959	18,454	0	0	0	18,454
Missouri Housing Development Commission	16,698,396	17,323,754	14,770	1,345,019	692,207	0	2,051,996	201,380	0	0	656,539	857,919
Missouri Public Entity Risk Management Fund	1,676,043	1,961,021	1,672	152,254	78,357	76,388	308,671	22,796	0	0	57,598	80,394
Missouri Technology Corporation	598,714	450,973	384	35,014	18,020	18,835	72,253	5,242	0	0	104,353	109,595
Missouri Wine and Grape Board	791,164	833,137	710	64,685	33,290	26,350	125,035	9,685	0	0	16,286	25,971
Harris Stowe State University	24,001,727	27,063,797	23,074	2,101,238	1,081,391	1,066,921	4,272,624	314,603	0	0	0	314,603
Lincoln University	41,490,674	45,197,671	38,535	3,509,154	1,805,969	138,194	5,491,852	525,400	0	0	1,312,498	1,837,898
Missouri Southern State University	55,206,935	60,464,168	51,551	4,694,448	2,415,974	353,916	7,515,889	702,865	0	0	1,206,603	1,909,468
Missouri State University	278,020,423	299,767,062	255,579	23,273,963	11,977,827	0	35,507,369	3,484,640	0	0	1,210,220	4,694,860
Missouri Western State University	59,509,555	63,881,653	54,465	4,959,782	2,552,527	25,909	7,592,683	742,592	0	0	300,266	1,042,858
Northwest Missouri State University	84,408,155	92,777,614	79,102	7,203,269	3,707,126	933,113	11,922,610	1,078,493	0	0	1,111,172	2,189,665
Southeast Missouri State University	128,922,745	128,178,153	109,284	9,951,772	5,121,629	9,206	15,191,891	1,490,006	0	0	8,518,644	10,008,650
State Technical College of Missouri	25,136,177	28,431,577	24,241	2,207,432	1,136,044	876,363	4,244,080	330,503	0	0	57,634	388,137
Truman State University	89,261,516	95,729,325	81,618	7,432,440	3,825,068	8,285	11,347,411	1,112,805	0	0	1,794,967	2,907,772
University of Central Missouri	148,795,169	145,766,631	124,280	11,317,345	5,824,414	222,723	17,488,762	1,694,463	0	0	11,988,487	13,682,950

In addition, it is the employer’s responsibility to adjust these numbers for any employer contributions subsequent to the Measurement Date, which are to be reported as a Deferred Outflow of Resources. Please consult GASB 68, Paragraph 89.

Exhibit 3

Missouri State Employees' Retirement System

Schedule of Pension Amounts by Employer

Measurement Date: 6/30/2019

Entity	Pension Expense: Proportionate Share of Plan Pension Expense	Pension Expense: Net Recognition of Deferred Amounts from Changes in Proportionate Share	Pension Expense: Total Employer Pension Expense
Total	$1,227,630,804	$0	$1,227,630,804
State of Missouri	1,020,483,439	12,903,033	1,033,386,472
Environmental Improvement & Energy Resource Authority	92,060	(134,158)	(42,098)
Missouri Agriculture & Small Business Development Authority	116,158	(23,164)	92,994
Missouri Consolidated Health Care Plan (MCHCP)	1,815,040	(117,424)	1,697,616
Missouri Development Finance Board	322,597	15,463	338,060
Missouri Housing Development Commission	3,520,379	(269,249)	3,251,130
Missouri Public Entity Risk Management Fund	398,501	(17,613)	380,888
Missouri Technology Corporation	91,643	(26,802)	64,841
Missouri Wine and Grape Board	169,303	24,107	193,410
Harris Stowe State University	5,499,663	738,472	6,238,135
Lincoln University	9,184,667	(1,076,889)	8,107,778
Missouri Southern State University	12,286,988	(1,060,601)	11,226,387
Missouri State University	60,915,986	(325,609)	60,590,377
Missouri Western State University	12,981,459	(141,974)	12,839,485
Northwest Missouri State University	18,853,438	117,432	18,970,870
Southeast Missouri State University	26,047,220	(4,174,270)	21,872,950
State Technical College of Missouri	5,777,611	545,408	6,323,019
Truman State University	19,453,259	(1,334,830)	18,118,429
University of Central Missouri	29,621,393	(5,641,332)	23,980,061

Exhibit 4

Missouri State Employees' Retirement System

Schedule of Recognition Amounts by Employer

Measurement Date: 6/30/2019

Entity	NPL Sensitivities 1% Decrease (6.10%)	NPL Sensitivities Current Discount Rate (7.10%)	NPL Sensitivities 1% Increase (8.10%)	Schedule of Recognition of Deferred Outflows/(Inflows) of Resources for Fiscal Year 2020	2021	2022	2023	2024	Thereafter
Total	$7,621,213,358	$6,041,161,030	$4,712,721,302	$358,321,525	$178,693,213	$57,640,469	$50,694,098	$0	$0
State of Missouri	6,335,228,791	5,021,790,560	3,917,508,445	311,112,782	158,675,995	49,524,228	42,140,102	0	0
Environmental Improvement & Energy Resource Authority	571,515	453,027	353,407	(117,164)	(118,920)	(26,958)	3,802	0	0
Missouri Agriculture & Small Business Development Authority	721,119	571,615	445,918	22,827	25,703	8,478	4,797	0	0
Missouri Consolidated Health Care Plan (MCHCP)	11,267,888	8,931,796	6,967,711	444,148	214,984	77,657	74,951	0	0
Missouri Development Finance Board	2,002,702	1,587,496	1,238,409	112,545	56,501	17,138	13,321	0	0
Missouri Housing Development Commission	21,854,744	17,323,754	13,514,294	683,613	246,070	119,023	145,371	0	0
Missouri Public Entity Risk Management Fund	2,473,922	1,961,021	1,529,796	110,816	73,416	27,589	16,456	0	0
Missouri Technology Corporation	568,924	450,973	351,805	(7,777)	(25,640)	(7,710)	3,784	0	0
Missouri Wine and Grape Board	1,051,042	833,137	649,931	57,029	28,538	6,507	6,991	0	0
Harris Stowe State University	34,142,274	27,063,797	21,112,520	2,222,653	1,184,913	323,351	227,104	0	0
Lincoln University	57,019,022	45,197,671	35,258,790	1,888,000	939,376	447,304	379,274	0	0
Missouri Southern State University	76,278,438	60,464,168	47,168,214	2,860,908	1,620,093	618,038	507,382	0	0
Missouri State University	378,170,475	299,767,062	233,848,860	17,124,027	8,393,438	2,779,564	2,515,480	0	0
Missouri Western State University	80,589,759	63,881,653	49,834,200	3,681,491	1,757,214	575,059	536,060	0	0
Northwest Missouri State University	117,043,394	92,777,614	72,375,994	5,321,244	2,664,890	968,273	778,539	0	0
Southeast Missouri State University	161,702,866	128,178,153	99,992,023	3,335,966	245,000	526,675	1,075,601	0	0
State Technical College of Missouri	35,867,793	28,431,577	22,179,527	2,065,206	1,207,283	344,872	238,582	0	0
Truman State University	120,767,119	95,729,325	74,678,630	4,629,340	2,150,776	856,216	803,308	0	0
University of Central Missouri	183,891,571	145,766,631	113,712,828	2,773,871	(646,417)	455,165	1,223,193	0	0

Deferred Outflows for contributions made after 6/30/19 are not reflected. Please consult GASB 68, Paragraph 89.

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GASB STATEMENT NO. 68 REPORT

FOR THE

MISSOURI STATE EMPLOYEES'

RETIREMENT SYSTEM

JUDGES

MEASUREMENT DATE: JUNE 30, 2019

Cavanaugh Macdonald
CONSULTING, LLC
The experience and dedication you deserve

November 4, 2019

Board of Trustees
Missouri State Employee' Retirement System
907 Wildwood Drive
Jefferson City, Missouri 65109

Dear Board Members:

Presented in this report is information to assist the Missouri State Employees' Retirement System in providing information required under the Governmental Accounting Standards Board (GASB) Statement No. 68 to the State of Missouri. GASB Statement No. 68 establishes accounting and financial reporting requirements for governmental employers who provide pension benefits to their employees through a trust. This report has been prepared as of June 30, 2019. The calculations in this report have been made on a basis that is consistent with our understanding of this accounting standard (GASB 68). Please note that the discount rate used to determine the Total Pension Liability changed from 7.25% at the Prior Measurement Date to 7.10% at the current Measurement Date.

The annual actuarial valuation used as a basis for much of the information presented in this report was performed as of June 30, 2019. The valuation was based upon data, furnished by the System's staff, concerning active, inactive and retired members along with pertinent financial information. This information was reviewed for completeness and internal consistency, but was not audited by us. The valuation results depend on the integrity of the data. If any of the information is inaccurate or incomplete, our results may be different and our calculations may need to be revised. Please see the actuarial valuation for additional details on the funding requirements for the System, including actuarial assumptions and methods and the funding policy.

To the best of our knowledge, the information contained in this report is complete and accurate. The calculations were performed by qualified actuaries according to generally accepted actuarial principles and practices, as well as in conformity with Actuarial Standards of Practice issued by the Actuarial Standards Board. The calculations are based on the current provisions of the System, and on actuarial assumptions that are internally consistent and individually reasonable based on the actual experience of the System. In addition, the calculations were completed in compliance with applicable law and, in our opinion, meet the requirements of GASB 68.

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These results are only for financial reporting and may not be appropriate for funding purposes or other types of analysis. Calculations for purposes other than satisfying the requirements of GASB 68 may produce significantly different results. Future actuarial results may differ significantly from the current results presented in this report due to such factors as changes in plan experience or changes in economic or demographic assumptions.

We, Patrice A. Beckham, FSA and Bryan K. Hoge, FSA, are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein. We are available to answer any questions on the material contained in this report or to provide explanations or further details as may be appropriate.

Respectfully submitted,

Patrice Beckham

Patrice Beckham, FSA, EA, FCA, MAAA
Principal and Consulting Actuary

Bryan K. Hoge, FSA, EA, FCA, MAAA
Senior Actuary

TABLE OF CONTENTS

GASB STATEMENT NO. 68

MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

SECTION I - SUMMARY OF PRINCIPAL RESULTS

Valuation Date (VD):	June 30, 2019
Prior Measurement Date:	June 30, 2018
Measurement Date (MD):	June 30, 2019
Membership Data:	
Retirees and Beneficiaries	585
Inactive Vested Members	36
Inactive Nonvested Members	0
Active Employees	414
Total	1,035
Single Equivalent Interest Rate (SEIR):	
Long-Term Expected Rate of Return	7.10%
Municipal Bond Index Rate at Prior Measurement Date	3.89%
Municipal Bond Index Rate at Measurement Date	3.50%
Year in which Fiduciary Net Position is Projected to be Depleted	N/A
Single Equivalent Interest Rate at Prior Measurement Date	7.25%
Single Equivalent Interest Rate at Measurement Date	7.10%
Net Pension Liability:	
Total Pension Liability (TPL)	$617,482,705
Fiduciary Net Position (FNP)	158,332,990
Net Pension Liability (NPL = TPL – FNP)	$459,149,715
FNP as a percentage of TPL	25.64%
Collective Pension Expense:	$64,293,507
Collective Deferred Outflows of Resources:	$20,327,211
Collective Deferred Inflows of Resources:	$3,111,242

SECTION II – INTRODUCTION

The Governmental Accounting Standards Board issued Statement No. 68 (GASB 68), *"Accounting and Financial Reporting for Pensions"* in June 2012. GASB 68's effective date for employers was the first fiscal year beginning after June 15, 2014. The Missouri State Employees' Retirement System for Judges (Judges or System) is a single-employer defined benefit pension plan.

This report, prepared as of June 30, 2019 (the Measurement Date), presents information to assist Missouri State Employees' Retirement System for Judges in providing the required information under GASB 68 to the State of Missouri. Much of the material provided in this report, including the Net Pension Liability, is based on the results of the GASB 67 report for the Missouri State Employees' Retirement System for Judges, which was issued September 27, 2019. See the GASB 67 report for more information on the member data, actuarial assumptions, and methods used in developing the GASB 67 results.

GASB 68 requires the inclusion of a Net Pension Liability (NPL) on the employer's Statement of Net Position and a determination of a Pension Expense (PE) in the Notes to the Financial Statements, that may bear little relationship to the employer's funding requirements. In fact, it is possible in some years for the NPL to be an asset or the PE to be an income item. The NPL is set equal to the Total Pension Liability (TPL) minus the Fiduciary Net Position (FNP). The benefit provisions recognized in the calculation of the TPL are summarized in Appendix B.

PE includes amounts for Service Cost (the Normal Cost under Entry Age Normal (EAN) for the year), interest on the TPL, employee contributions, administrative expenses, other cash flows during the year, recognition of increases/decreases in the TPL due to changes in the benefit structure, actual versus expected experience, actuarial assumption changes, and recognition of investment gains/losses. The actual experience and assumption change impacts are recognized over the average expected remaining service life of the System membership as of the beginning of the measurement period, while investment gains/losses are recognized equally over five years. The development of the PE is shown in Section III.

The unrecognized portions of each year's experience, assumption changes and investment gains/losses are used to develop the Deferred Outflows of Resources and Deferred Inflows of Resources, which also must be included on the employer's Statement of Net Position.

Among the items needed for the TPL calculation is a discount rate, as defined by GASB, or a Single Equivalent Interest Rate (SEIR). To determine the SEIR, the FNP must be projected into the future for as long as there are anticipated benefits payable under the plan provisions applicable to the membership and beneficiaries of the System on the Measurement Date. If the FNP is not projected to be depleted at any point in the future, the long-term expected rate of return on plan investments expected to be used to finance the benefit payments may be used as the SEIR.

If, however, the FNP is projected to be depleted at a future measurement date, the SEIR is determined as the single rate that will generate a present value of benefit payments equal to the sum of the present value

determined by discounting all projected benefit payments through the date of depletion by the long-term expected rate of return, and the present value determined by discounting those benefits after the date of depletion by a 20-year tax-exempt municipal bond (rating AA/Aa or higher) rate. The rate used, if necessary, for this purpose is the monthly average of the Bond Buyers General Obligation 20-year Municipal Bond Index Rate (formerly published monthly by the Board of Governors of the Federal Reserve System).

Our calculations indicate that the FNP is not projected to be depleted, so the Municipal Bond Index Rate is not used in the determination of the SEIR for either the June 30, 2018 or the June 30, 2019 TPL. The SEIR for the Measurement Date is 7.10%, the long-term assumed rate of return on investments. The SEIR for the Prior Measurement Date was 7.25%.

The FNP projections are based on the System's financial status on the Measurement Date, the indicated set of methods and assumptions, and the requirements of GASB 67 and 68. As such, the FNP projections are not reflective of the cash flows and asset accumulations that would occur on an ongoing plan basis, reflecting the impact of future members. Therefore, the results of this test do not necessarily indicate whether or not the fund will actually run out of money, the financial condition of the System, or the System's ability to make benefit payments in future years.

The sections that follow provide the results of all the required calculations, presented in the order laid out in GASB 68 for note disclosure and Required Supplementary Information (RSI).

SECTION III – PENSION EXPENSE

As noted earlier, the Pension Expense (PE) consists of a number of different items. GASB 68 refers to the first item as Service Cost, which is the Normal Cost using the Entry Age Normal (EAN) actuarial funding method. The second item is interest on the TPL at 7.25%, the SEIR in effect as of the Prior Measurement Date.

The next three items refer to any changes that occurred in the TPL due to:

- benefit changes,
- actual versus expected experience, or
- changes in actuarial assumptions or other inputs.

Benefit changes, which are reflected immediately in PE, will increase PE if there is a benefit improvement for existing System members, or decrease PE if there is a benefit reduction. For the plan year ended June 30, 2018, there were no benefit changes to be recognized.

The next item to be recognized is the portion of current year change in TPL due to actual versus expected System experience for the year. The portion to recognize in the current year is determined by spreading the total change over the average expected remaining service life of the entire System membership at the beginning of the measurement period. The average expected remaining service life of active members is the average number of years the active members are expected to remain in covered employment. At the beginning of the measurement period, this number is 9.643 years. The average expected remaining service life of the inactive members is zero. Therefore, the recognition period is the weighted average of these two amounts, or 3.962 years.

The last item under changes in TPL is changes in actuarial assumptions or other inputs. There were a few changes in the actuarial assumptions or other inputs since the Prior Measurement Date. The biggest change was a decrease in the long-term rate of return from 7.25% to 7.10%. The other changes were decreases in price inflation, the payroll and wage growth assumptions and the cost-of-living adjustment assumption. These changes will be recognized over the average expected remaining service life of the entire System membership, using the same approach that applied to experience gains and losses, as described earlier.

Employee contributions for the year and projected earnings on the FNP (using long-term expected rate of return) are subtracted from the amount determined thus far. One-fifth of the current-period difference between projected and actual earnings on the FNP is recognized in the PE.

The current year portions of previously determined experience, assumption changes and earnings amounts, recognized as Deferred Outflows of Resources and Deferred Inflows of Resources are included next. Deferred Outflows of Resources are added to the PE while Deferred Inflows of Resources are subtracted from the PE. Finally, administrative expenses and other miscellaneous items are included.

The calculation of the PE for the year ended June 30, 2019 is shown in the following table.

Pension Expense
For the Year Ended

June 30, 2019	
Service Cost at end of year	$13,573,453
Interest on the Total Pension Liability	41,710,768
Benefit term changes	0
Expensed portion of current-period difference between expected and actual experience in the Total Pension Liability	247,068
Expensed portion of current-period assumption changes	1,268,061
Employee contributions	(1,138,101)
Projected earnings on plan investments	(10,963,464)
Expensed portion of current-period differences between projected and actual earnings on plan investments	981,526
Administrative expenses	72,141
Other	0
Recognition of beginning Deferred Outflows of Resources	22,814,281
Recognition of beginning Deferred Inflows of Resources	(4,272,226)
Total Pension Expense	**$64,293,507**

Note: System experience and assumption changes are recognized over the average expected remaining service life for all System members, which is 3.962 years.

SECTION IV – NOTES TO FINANCIAL STATEMENTS

The material presented herein will follow the order presented in GASB 68. Paragraph numbers are provided for ease of reference.

Paragraph 37: The information required is to be prepared by the System and employer.

Paragraph 38: The information required is to be prepared by the System and employer.

Paragraph 39: Not Applicable.

Paragraph 40(a) – (b): The information required is to be supplied by the System.

Paragraph 40(c): The data required regarding the membership of the System were furnished by the System. The following table summarizes the membership of the System as of June 30, 2019, the date of the valuation used to determine the June 30, 2019 TPL.

Membership

Number as of June 30, 2019	
Inactive Members Or Their Beneficiaries Currently Receiving Benefits	585
Inactive Members Entitled To But Not Yet Receiving Benefits	36
Inactive Nonvested Members	0
Active Members	414
Total	1,035

Paragraph 40(d) – (e): The information required is to be supplied by the System.

Paragraph 41: This paragraph requires information to be disclosed regarding the actuarial assumptions and other inputs used to measure the TPL. The complete set of actuarial assumptions and other inputs utilized in developing the TPL are outlined in Appendix C. The TPL as of June 30, 2019 was determined based on an actuarial valuation prepared as of June 30, 2019, using the following key actuarial assumptions and other inputs:

Price Inflation	2.35 percent
Payroll Growth	2.35 percent
Salary increases, including wage inflation	2.60 to 4.80 percent
Long-term Rate of Return, net of investment expense, including price inflation	7.10 percent
Municipal Bond Index Rate	3.50 percent
Year FNP is projected to be depleted	N/A
Single Equivalent Interest Rate, net of investment expense, including price inflation	7.10 percent
Cost-of-living adjustment	4.00%, compounded annually, when a minimum COLA of 4.00% is in effect. 1.88%, compounded annually, when no minimum COLA is in effect (80% of price inflation).
Mortality	Pre-retirement mortality rates were based on the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015. Post-retirement mortality rates were based on the RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 98%. Disabled mortality rates were based on the RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015.

The demographic actuarial assumptions used in the valuation are based on the results of the most recent complete actuarial experience study, which covered the five-year period ending June 30, 2015. The experience study report, performed by the prior actuary, is dated March 28, 2016. The economic actuarial assumptions used in the valuation are based on the results of the most recent economic experience study, which was performed in July, 2018.

Paragraph 42:

(a): Discount rate (SEIR). The discount rate used to measure the TPL at June 30, 2019 was 7.10%. The discount rate used to measure the TPL at the Prior Measurement Date was 7.25%.

(b): Projected cash flows. The projection of cash flows used to determine the discount rate assumed that plan contributions from members and the State of Missouri will be made at the contribution rates as set in state statute:

a. Employee contribution rate: 4.00% of salary for members hired on or after 1/1/2011; no contributions for members hired before 1/1/2011.
b. Employer contribution rate: The actuarial required contribution rate is determined as of the Prior Measurement Date (June 30, 2017 for FYE June 30, 2019) and is subject to a minimum contribution rate of 58.45% until the plan is at least 80% funded.
c. Administrative expenses in the prior year were projected forward with price inflation as an estimate for administrative expenses in the current and future years. The portion of expenses in future years allocated to the current members was based on the proportionate share of covered payroll in each year for the remainder of the existing members to the total covered payroll for all members.

Based on those assumptions, the System's FNP was projected to be available to make all projected future benefit payments of current System members. Therefore, the long-term expected rate of return on System investments of 7.10% was applied to all periods of projected benefit payments to determine the TPL.

The FNP projections are based on the System's financial status on the Measurement Date, the indicated set of methods and assumptions, and the requirements of GASB 67 and 68. As such, the FNP projections are not reflective of the cash flows and asset accumulations that would occur on an ongoing plan basis, reflecting the impact of future members. Therefore, the results of this test do not necessarily indicate whether or not the System will actually run out of money, the financial condition of the System, or the System's ability to make benefit payments in future years.

(c): Long-term rate of return. The long-term expected rate of return on pension plan investments is reviewed regularly as part of the experience study. The most recent economic experience analysis was performed and results provided in July, 2018. Generally, several factors are considered in evaluating the long-term rate of return assumption including long-term historical data, estimates inherent in current market data, and an analysis in which best-estimate ranges of expected future real rates of return (expected returns, net of investment expense and inflation), along with estimates of variability and correlations for each asset class, were developed by the System's investment consultant. These ranges were combined to develop the long-term expected rate of return by weighting the expected future real rates of return by the target asset allocation percentage and then adding expected inflation. The capital market assumptions developed by

investment consultants are often intended for use over a 10-year investment horizon and are not always useful in setting the long-term rate of return for funding pension plans which covers a longer timeframe.

(d): Municipal bond rate. A municipal bond rate was not used in determining the discount rate. If it were required, the rate would be 3.50% on the Measurement Date.

(e): Periods of projected benefit payments. Projected future benefit payments for all current plan members were projected through 2118.

(f): Assumed asset allocation. The target asset allocation and best estimates of real rates of return for each major asset class will be supplied by the System.

(g): Sensitivity analysis. This paragraph requires disclosure of the sensitivity of the NPL to changes in the discount rate. The following presents the NPL of the System, calculated using the discount rate of 7.10 percent, as well as the System's NPL calculated using a discount rate that is 1-percentage-point lower (6.10 percent) or 1-percentage-point higher (8.10 percent) than the current rate:

	1% Decrease (6.10%)	Current Discount Rate (7.10%)	1% Increase (8.10%)
Total Pension Liability	$681,056,801	$617,482,705	$563,195,426
Fiduciary Net Position	158,332,990	158,332,990	158,332,990
Net Pension Liability	$522,723,811	$459,149,715	$404,862,436

Paragraph 43: The required information will be supplied by the System.

Paragraph 44 (a) – (c): This paragraph requires a schedule of changes in the NPL. The needed information is provided in the table below for reporting year ended June 30:

	Total Pension Liability (a)	Plan Fiduciary Net Position (b)	Net Pension Liability (a) – (b)
Balances at June 30, 2018	$593,788,592	$150,199,575	$443,589,017
Changes for the year:			
Service Cost at end of year	13,573,453		13,573,453
Interest on TPL	41,710,768		41,710,768
Benefit term changes	0		0
Differences between expected and actual experience	978,884		978,884
Assumption changes	5,024,057		5,024,057
Employer contributions		38,604,668	(38,604,668)
Non-employer contributions		0	0
Employee contributions		1,138,101	(1,138,101)
Net investment income		6,055,836	(6,055,836)
Benefit payments, including member refunds	(37,593,049)	(37,593,049)	0
Administrative expenses		(72,141)	72,141
Other		0	0
Net changes	23,694,113	8,133,415	15,560,698
Balances at June 30, 2019	$617,482,705	$158,332,990	$459,149,715

Paragraph 44(d): There is no special funding situation.

Paragraph 45:

(a): The Measurement Date of the NPL is June 30, 2019. The TPL as of June 30, 2019 was determined based on the annual actuarial valuation report prepared as of June 30, 2019.

(b): There is no special funding situation.

(c): There were a few changes in the actuarial assumptions or other inputs since the Prior Measurement Date. The biggest change was a decrease in the long-term rate of return from 7.25% to 7.10%. The other changes were decreases in the price inflation assumption, the payroll and wage growth assumptions and the cost-of-living adjustment assumption

(d): There were no changes in the benefit terms since the Prior Measurement Date.

(e): There were no benefit payments in the measurement period attributable to the purchase of allocated insurance contracts.

(f): The information will be supplied by the System and employer.

(g): Please see Section III for the development of the PE.

(h): Since certain expense items are recognized over closed periods each year, the deferred portions of these items must be tracked annually. If the amounts will increase PE they are labeled Deferred Outflows of Resources. If the amounts serve to reduce PE they are labeled Deferred Inflows of Resources. The recognition of these amounts is accomplished on a level dollar basis, with no interest included in the deferred amounts. Experience gains/losses and the impact of changes in actuarial assumptions or other inputs, if any, are recognized over the average expected remaining service life of the active and inactive System members at the beginning of the measurement period. The difference between projected and actual earnings is recognized over a fixed five-year period.

The following tables provide a summary of the amounts of the Deferred Outflows of Resources and Inflows of Resources as of the Measurement Date (June 30, 2019). Per GASB 68, reporting of the differences between projected and actual earnings should be on a net basis, with only one Deferred Outflow or Inflow. This information is provided in the following table.

	Deferred Outflows of Resources	Deferred Inflows of Resources	Net Deferred Outflows/(Inflows) of Resources
Differences between expected and actual experience	$731,816	$2,939,905	($2,208,089)
Changes of assumptions	11,469,004	0	11,469,004
Differences between projected and actual earnings	8,126,391	171,337	7,955,054
Total	$20,327,211	$3,111,242	$17,215,969

The following tables show the Deferred Outflows of Resources and Deferred Inflows of Resources separately to provide additional detail.

Deferred Outflows of Resources								
		June 30, 2018		Additions		Recognition		June 30, 2019
Differences between expected and actual experience								
2015 Base	$	0	$	0	$	0	$	0
2016 Base		0		0		0		0
2017 Base		0		0		0		0
2018 Base		0		0		0		0
2019 Base		0		978,884		247,068		731,816
Total	$	0	$	978,884	$	247,068	$	731,816
Changes of assumptions								
2015 Base	$	0	$	0	$	0	$	0
2016 Base		11,578,669		0		11,578,669		0
2017 Base		3,767,562		0		2,068,952		1,698,610
2018 Base		9,173,220		0		3,158,822		6,014,398
2019 Base		0		5,024,057		1,268,061		3,755,996
Total	$	24,519,451	$	5,024,057	$	18,074,504	$	11,469,004
Differences between projected and actual earnings								
2015 Base	$	2,858,982	$	0	$	2,858,982	$	0
2016 Base		4,194,839		0		2,097,420		2,097,419
2017 Base		3,154,306		0		1,051,436		2,102,870
2018 Base		0		0		0		0
2019 Base		0		4,907,628		981,526		3,926,102
Total	$	10,208,127	$	4,907,628	$	6,989,364	$	8,126,391
Total	$	34,727,578	$	10,910,569	$	25,310,936	$	20,327,211

Deferred Inflows of Resources								
	June 30, 2018		Additions		Recognition		June 30, 2019	
Differences between expected and actual experience								
2015 Base	$	0	$	0	$	0	$	0
2016 Base		1,080,140		0		1,080,140		0
2017 Base		5,093,219		0		2,796,936		2,296,283
2018 Base		981,659		0		338,037		643,622
2019 Base		0		0		0		0
Total	$	7,155,018	$	0	$	4,215,113	$	2,939,905
Changes of assumptions								
2015 Base	$	0	$	0	$	0	$	0
2016 Base		0		0		0		0
2017 Base		0		0		0		0
2018 Base		0		0		0		0
2019 Base		0		0		0		0
Total	$	0	$	0	$	0	$	0
Differences between projected and actual earnings								
2015 Base	$	0	$	0	$	0	$	0
2016 Base		0		0		0		0
2017 Base		0		0		0		0
2018 Base		228,450		0		57,113		171,337
2019 Base		0		0		0		0
Total	$	228,450	$	0	$	57,113	$	171,337
Total	$	7,383,468	$	0	$	4,272,226	$	3,111,242

(i): Amounts reported as Deferred Outflows of Resources and Deferred Inflows of Resources related to pensions will be recognized in PE in future fiscal years as follows:

Year Ending June 30:	Deferred Outflows of Resources	Deferred Inflows of Resources	Net Deferred Outflows/(Inflows) of Resources
2020	$10,502,942	$2,691,433	$7,811,509
2021	6,403,665	362,698	6,040,967
2022	2,439,080	57,111	2,381,969
2023	981,524	0	981,524
2024	0	0	0
Thereafter	0	0	0

(j): Based on information supplied by the System, the Missouri State Employees' Retirement System for Judges receives no revenue from non-employer contributing entities.

SECTION V – REQUIRED SUPPLEMENTARY INFORMATION

There are several tables of Required Supplementary Information (RSI) that need to be included in the System's financial statements:

Paragraphs 46(a) - (c): The required tables of schedules are provided in Appendix A.

Paragraph 47: Significant methods and assumptions used in calculating the Actuarially Determined Contributions, if any, should be presented as notes to the schedule required by paragraph 46(c). In addition, for each of the schedules required by paragraph 46, information should be presented about factors that significantly affect trends in the amounts reported.

Changes of benefit and funding terms: The following changes were made by the Missouri General Assembly and reflected in the valuation performed as of June 30 listed below:

None

Changes in actuarial assumptions and methods:

6/30/2019 valuation:

- The investment return assumption was lowered from 7.25% to 7.10%.
- The price inflation assumption was lowered from 2.50% to 2.35%.
- The payroll growth assumption was lowered from 2.50% to 2.35%.
- The wage growth assumption was lowered from 2.75% to 2.60%.
- The cost-of-living adjustment (COLA) assumption was lowered from 2.00% to 1.88% when no minimum COLA is in effect (80% of price inflation).

6/30/2018 valuation:

- The investment return assumption was lowered from 7.50% to 7.25%.
- The payroll growth assumption was lowered from 3.00% to 2.50%.
- The wage growth assumption was lowered from 3.00% to 2.75%.
- The asset smoothing method was changed from an open 5-year smoothing method to a closed 5-year smoothing method, with the difference between the actual investment return and the expected investment return on the market value of assets recognized evenly over a closed 5-year period. Due to the change in the asset smoothing method, a transitional plan was necessary. This transitional plan recognizes the unrecognized investment experience as of June 30, 2017 evenly over a closed 7-year period.
- The Unfunded Actuarially Accrued Liability (UAAL) amortization method was changed from one base over a closed 30-year period that began June 30, 2014 to a "layered" approach first effective June 30, 2018. The "Legacy UAAL", as determined

in the June 30, 2018 valuation, is amortized over a closed 30-year period. Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System's benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases.

6/30/2017 valuation:

- The investment return assumption was lowered from 7.65% to 7.50%.

6/30/2016 valuation:

- The long-term rate of return was lowered from 8.00% to 7.65%.
- Post-retirement mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA to the RP-2014 healthy annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 98%.
- Pre-retirement mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA to the RP-2014 employee mortality table, projected from 2006 to 2026 with Scale MP-2015.
- The disabled mortality table was updated from the RP-2000 combined healthy mortality table, projected to 2016 with Scale AA and set forward 10 years to the RP-2014 disabled mortality table, projected from 2006 to 2026 with Scale MP-2015.
- Retirement rates were changed to better reflect actual experience of the System.
- Withdrawal rates were changed to better reflect actual experience of the System.
- The marriage assumption at retirement was increased from 70% to 80%.
- The marriage assumption for in-service deaths was increased from 70% to 80%.
- The asset smoothing period changed from an open 3-year period to an open 5-year period.

6/30/2014 valuation:

- For the 2014 valuation only, a one-time adjustment to the payroll growth from 3.00% to 14.38% was assumed for the year after the valuation date to reflect the average planned salary increase for 2015.
- The unfunded actuarial accrued liability amortization method was changed from a level percentage of payroll amortized over an open 30-year period to a level percentage of payroll amortized over a closed 30-year period beginning with the 6/30/2014 valuation.

Method and assumptions used in calculations of actuarially determined contributions.

The System is funded with contribution rates that are 4.00% of monthly salary for members hired on or after January 1, 2011 (0% for all other members) and an actuarially determined rate for the State of Missouri (subject to a minimum rate of 58.45% until the System is 80% funded on an actuarial basis). The Actuarially Determined Contributions in the *Schedule of Employer Contributions* are calculated as of the fiscal year two years prior to which contributions are reported.

The following actuarial methods and assumptions were used to determine the Actuarially Determined Contribution reported for the most recent Measurement Date, June 30, 2019 (based on the June 30, 2017 actuarial valuation):

Actuarial cost method	Entry Age Normal
Amortization method	Level percentage of payroll, closed
Remaining amortization period	27 years
Asset valuation method	Open 5-year smoothing based on actual market return and expected actuarial return
Price Inflation	2.50 percent
Payroll Growth	3.00 percent
Salary increases, including inflation	3.00 to 5.20 percent
Long-term Rate of Return, net of investment expense, including price inflation	7.50 percent
Cost-of-living adjustment	4.00%, compounded annually, when a minimum COLA of 4.00% is in effect. 2.00%, compounded annually, when no minimum COLA is in effect (80% of price inflation).

Please see the information presented earlier in regard to Paragraph 47 for detailed information on the benefit changes and assumption changes that may have impacted the Actuarially Determined Contributions shown in the *Schedule of Employer Contributions.*

APPENDIX A

REQUIRED SUPPLEMENTARY INFORMATION

Exhibit A

GASB 68 Paragraphs 46(a)
SCHEDULE OF CHANGES IN THE NET PENSION LIABILITY

	2019	2018	2017	2016	2015	2014
Total Pension Liability						
Service Cost	13,573,453	12,997,198	12,945,567	10,932,097	10,613,686	8,990,293
Interest	41,710,768	41,018,371	40,617,091	37,755,240	36,161,612	34,013,615
Benefit term changes	0	0	0	0	0	0
Differences between expected and actual experience	978,884	(1,319,696)	(10,687,091)	(5,036,696)	5,103,664	13,360,614
Assumption changes	5,024,057	12,332,042	7,905,466	53,991,379	0	0
Benefit payments, including member refunds	(37,593,049)	(35,657,248)	(33,984,725)	(32,989,714)	(31,245,906)	(29,406,625)
Net change in Total Pension Liability	23,694,113	29,370,667	16,796,308	64,652,306	20,633,056	26,957,897
Total Pension Liability - beginning	593,788,592	564,417,925	547,621,617	482,969,311	462,336,255	435,378,358
Total Pension Liability - ending (a)	617,482,705	593,788,592	564,417,925	547,621,617	482,969,311	462,336,255
Plan Fiduciary Net Position						
Employer contributions	38,604,668	36,892,203	34,246,826	33,642,497	32,696,686	29,264,877
Employee contributions	1,138,101	902,319	786,745	661,206	488,193	294,810
Net investment income	6,055,836	10,677,666	4,680,131	28,082	(3,610,352)	21,394,750
Benefit payments, including member refunds	(37,593,049)	(35,657,248)	(33,984,725)	(32,989,714)	(31,245,906)	(29,406,625)
Administrative expenses	(72,141)	(181,595)	(150,387)	(136,983)	(123,015)	(105,693)
Other	0	(68,711)	0	0	0	0
Net change in Plan Fiduciary Net Position	8,133,415	12,564,634	5,578,590	1,205,088	(1,794,394)	21,442,119
Plan Fiduciary Net Position – beginning	150,199,575	137,634,941	132,056,351	130,851,263	132,645,657	111,203,538
Plan Fiduciary Net Position - ending (b)	158,332,990	150,199,575	137,634,941	132,056,351	130,851,263	132,645,657
Net Pension Liability - ending (a) - (b)	459,149,715	443,589,017	426,782,984	415,565,266	352,118,048	329,690,598

Note: Schedule is intended to show 10-year trend. Additional years will be reported as they become available.

0

Exhibit A (cont.)

GASB 68 Paragraphs 46(b)
SCHEDULE OF CHANGES IN THE NET PENSION LIABILITY

	2019	2018	2017	2016	2015	2014
Total Pension Liability	617,482,705	593,788,592	564,417,925	547,621,617	482,969,311	462,336,255
Plan Fiduciary Net Position	158,332,990	150,199,575	137,634,941	132,056,351	130,851,263	132,645,657
Net Pension Liability	459,149,715	443,589,017	426,782,984	415,565,266	352,118,048	329,690,598
Plan Fiduciary Net Position as a percentage of the Total Pension Liability	25.64%	25.30%	24.39%	24.11%	27.09%	28.69%
Covered payroll	60,594,362	59,417,302	58,591,661	57,421,016	55,656,457	49,587,936
Employers' Net Pension Liability as a percentage of covered payroll	757.74%	746.57%	728.40%	723.72%	632.66%	664.86%

Note: Schedule is intended to show 10-year trend. Additional years will be reported as they become available.

Exhibit B

GASB 68 Paragraphs 46(c)
SCHEDULE OF EMPLOYER CONTRIBUTIONS

Fiscal Year Ended June 30

	2019	2018	2017	2016	2015	2014
Actuarially determined employer contribution	$38,604,668	$36,892,203	$32,670,710	$33,642,497	$32,696,686	$29,264,877
Actual employer contributions	38,604,668	36,892,203	34,246,826	33,642,497	32,696,686	29,264,877
Annual contribution deficiency (excess)	$0	$0	($1,576,116)	$0	$0	$0
Covered payroll	$60,594,362	$59,417,302	$58,591,661	$57,421,016	$55,656,457	$49,587,936
Actual contributions as a percentage of covered payroll	63.71%	62.09%	58.45%	58.59%	58.75%	59.02%

Note: Information prior to 2017 was produced by the prior actuary.

APPENDIX B

SUMMARY OF PLAN PROVISIONS

Age and Service Retirement

Eligibility for Unreduced Benefit (for Members Hired Before 1/1/2011)

The earliest of attaining:

(1) At least 62 with 12 years of creditable service.
(2) At least 60 with 15 years of creditable service.
(3) At least 55 with 20 years of creditable service.

Eligibility for Unreduced Benefit (for Members Hired On or After 1/1/2011)

The earliest of attaining:

(1) At least 67 with 12 years of creditable service.
(2) At least 62 with 20 years of creditable service.

Benefit Amount

50% of compensation

Early Retirement

Eligibility for Reduced Benefit (for Members Hired Before 1/1/2011)

Age 60

Benefit Amount

(1) If between 60 and 62, years of service divided by 15 multiplied by 50% of compensation.
(2) If at least 62, years of service divided by 12 and multiplied by 50% of compensation.

Eligibility for Reduced Benefit (for Members Hired On or After 1/1/2011)

Age 62

Benefit Amount

(1) If between 60 and 67, years of service divided by 20 multiplied by 50% of compensation.
(2) If at least 67, years of service divided by 12 and multiplied by 50% of compensation.

Compensation used for Benefit Determination

The annual salary at date of termination of the highest position held.

Vested Deferred Benefits

Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested. Benefits commence once the individual qualifies for normal or early retirement based on age and service.

Death Benefits

Death Prior to Retirement

50% of the benefit the member would have been eligible to receive based on service to age 70 is payable to an eligible spouse or minor children.

Death After Retirement

50% of the benefit the retired member was receiving at the date of death to an eligible surviving spouse for members hired before January 1, 2011.

Disability Benefits

Disability benefits become payable at the time the member is eligible for normal retirement (50% of salary for remainder of term) and are computed based on the service that would have accrued if active employment had continued until normal retirement age, and member's compensation while an active employee.

Post-Retirement Benefit Adjustments

Benefits are increased to benefit recipients (including survivors) annually in accordance with the following formulas:

Increase in CPI	Formula 1 Benefit Increase	Formula 2 Benefit Increase
5.00% or less	4.00%	80% of CPI increase
5.01% - 6.24%	80% of CPI increase	80% of CPI increase
6.25% or more	5.00%	5.00%

Members first hired prior to August 28, 1997 receive COLAs based on Formula 1 until an aggregate increase of 65% is reached. At that point, subsequent COLAs based on Formula 2 are granted.

Members first hired on or after August 28, 1997 receive COLAs based solely on Formula 2.

Members hired prior to January 1, 2011 who work beyond the later of age 60 or the date when first eligible for age and service retirement will have their monthly benefit increased upon retirement. The percentage increase is equal to all COLAs for the years between (i) the later of age 60 or the date when first eligible for age and service retirement and (ii) date of actual retirement, not to exceed 65%.

Member Contributions

For members hired prior to 1/1/2011:	None
For members hired on or after 1/1/2011:	4.00% of salary, with interest credited at 4.00%.

APPENDIX C

STATEMENT OF ACTUARIAL ASSUMPTIONS

1. Investment Return

7.10%, compounded annually, net of investment expenses.

Note: This assumption will change to 6.95% for the June 30, 2020 valuation and thereafter, absent Board action.

2. Inflation

2.35% per year

Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

3. Salary Increases

Sample Ages	Inflation	Productivity	Merit	Increase Next Year
25	2.35%	0.25%	2.20%	4.80%
30	2.35	0.25	2.20	4.80
35	2.35	0.25	1.48	4.08
40	2.35	0.25	0.76	3.36
45	2.35	0.25	0.60	3.20
50	2.35	0.25	0.54	3.14
55	2.35	0.25	0.44	3.04
60	2.35	0.25	0.00	2.60
65	2.35	0.25	0.00	2.60
70	2.35	0.25	0.00	2.60

4. Payroll Growth

2.35% per year

Note: This assumption will change to 2.25% for the June 30, 2020 valuation and thereafter, absent Board action.

5. Cost-of-Living Adjustment (COLA)

4.00% on a compounded basis when a minimum COLA of 4.00% is in effect.

1.88% on a compounded basis when no minimum COLA is in effect.

Note: This assumption will change to 1.80% for the June 30, 2020 valuation and thereafter, absent Board action.

6. Interest on Member Contributions

1.50% per year

7. Administrative Expenses

Actual prior year expenses, included in normal cost rate.

Demographic Assumptions

1. Mortality — The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

   a. Post-retirement — RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 98%

   b. Pre-retirement — RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015

   c. Long-term disability — RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015

Sample Ages	Pre-Retirement Mortality Rates*	
	Males	Females
25	0.03%	0.01%
30	0.03	0.02
35	0.04	0.03
40	0.05	0.04
45	0.07	0.05
50	0.13	0.09
55	0.24	0.16
60	0.42	0.23
65	0.74	0.33
70	1.23	0.55

** The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015.*

2. Retirement Assumption

Retirement Age	Hired Before 1/1/2011 Normal Retirement Male	Normal Retirement Female	Early Retirement Male	Early Retirement Female	Hired On or After 1/1/2011 Retirement Age	Normal Retirement Male	Normal Retirement Female
55	20%	3%					
56	16%	3%					
57	13%	3%					
58	9%	3%					
59	5%	3%					
60	8%	8%					
61	5%	8%					
62	8%	8%	6%	3%	62	30%	35%
63	10%	8%	6%	3%	63	20%	20%
64	12%	8%	6%	3%	64	15%	20%
65	12%	15%	6%	3%	65	30%	50%
66	20%	15%	6%	3%	66	25%	25%
67	20%	15%	6%	3%	67	20%	25%
68	30%	15%	6%	3%	68	20%	25%
69	30%	15%	6%	3%	69	30%	50%
70	100%	100%	100%	100%	70	100%	100%

3. Disability Assumption

Sample Ages	Males	Females
25	0.01 %	0.01 %
30	0.02	0.01
35	0.03	0.02
40	0.04	0.03
45	0.05	0.04
50	0.08	0.07
55	0.13	0.12
60	0.20	0.19
65	0.20	0.19
70	0.20	0.19

4. Termination Assumption

Service Index	Percent of Active Members Separating within the Next Year Withdrawal	
	Males	Females
1	0.040 %	0.040 %
2	0.010	0.023
3	0.013	0.023
4	0.013	0.023
5	0.013	0.023
6-10	0.013	0.023
11-15	0.017	0.023
16+	0.010	0.010

Other Assumptions

1. Form of Payment — Hired before 1/1/2011 – 50% joint and survivor
   Hired on or after 1/1/2011 – Straight life annuity

2. Marital Status

   a. Percent married — 100% married

   b. Spouse's age — Females assumed to be four years younger than males.

3. Pay Increase Timing — Beginning of the fiscal year.

4. Decrement Timing — Decrements of all types are assumed to occur mid-year.

5. Eligibility Testing — Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

6. Benefit Service — Exact fractional service is used to determine the amount of the benefit payable.

7. Decrement Relativity — Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

8. Decrement Operation — Disability and withdrawal do not operate during normal retirement eligibility.

9. Other Liability Adjustments — None

10. Incidence of Contributions	Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made. New entrant normal cost contributions are applied to the funding of new entrant benefits.
11. Forfeitures	No vested member are assumed to take a refund of employee contributions.
12. Salary and Benefit Limits	For purposes of the valuation, no limits were applied to member compensation or benefits.
13. Commencement age for deferred vested benefit	Normal retirement age

Data Adjustments

Active and retired member data was reported as of May 31, 2019. It was brought forward to June 30, 2019 by adding one month of service for all active members, one month of contributions and interest for Judicial Plan 2011 members, and the June COLA for certain retired members. Financial information continues to be reported as of June 30. This procedure was instituted to provide sufficient time for the Board of Trustees to certify the appropriate contribution rate prior to the October 1 statutory deadline.

Active members reported with no annualized salary were assumed to receive the average active member pay.

TECHNICAL VALUATION PROCEDURES

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.